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SIMULTANEOUS MULTI-BOOTH VOTING-ENABLED SIMPLE ELECTRONIC VOTING MACHINE USING WIRELESS DATA TRANSMISSION

Abhishek Joshi
Student-3rd year Electronics and Communications Engineering (B.E), RNS Institute of Technology, Channasandra, Bangalore-India

Harish S
Student-3rd year Electronics and Communications Engineering (B.E), RNS Institute of Technology, Channasandra, Bangalore-India

Ashwini H R
Student-3rd year Electronics and Communications Engineering (B.E), RNS Institute of Technology, Channasandra, Bangalore-India

Harshitha R
Student-3rd year Electronics and Communications Engineering (B.E),RNS Institute of Technology, Channasandra, Bangalore-India

***Abstract*- The process of voting is one of the key elements of the present–day democratic world. One requires a systematic, unbiased, transparent, incorruptible process of casting our choices to build the world the way we want to. Long gone are the paper ballots and their manual counting for the results. This tedious and time consuming process gave way to the electronic voting system in this electronic era. The voting machines currently in use are fast, secure and require less manual work.**

The design of an electronic voting machine discussed in this paper is a very simple and flexible. It is an advanced improvised design that can adapt to both large scale and small scale voting. It can be used to include any number of candidates, with no upper limit. It uses an 8051 Microcontroller and Wireless communication module i.e., the RF transmitter and receiver module, to achieve various aspects such as simultaneous multi-booth voting, immediate transfer of data from all booths to a single place and secured storage of results at a single database. However, it is well within the limits of economic feasibility and most importantly, secure against unauthorized mishandling. This design stresses on multiple voting machines distributed over large areas, but working together as a single entity.

Index terms- 8051 Microcontroller, Voting, Storage and Security, Wireless RF Communication Module, LCD Display

I. INTRODUCTION

The design of an improvised electronic voting machine discussed in this section is a very convenient yet simple idea. It is also compact, feasible and highly secure. This incorporates separate voting booths that conduct voting simultaneously. In order for the votes to be counted however, instead of storing them in wait till the end of the voting session, each vote count is transmitted to a highly secure database from every booth. As the voting halts in all booths, the total vote count of the entire procedure is available at a single and secure space. Furthermore, there is no room for any kind of mishandling or malpractices, since no lengthy procedures are involved intermediate to the casting of votes and the final count. The entire essence of this unique design is in the fact that this wireless communication technique enables simultaneous voting in multiple booths while obtaining the final results at a single place immediately.

Reference [1] puts forth a simple design of voting machine using a microcontroller. The same, but with small changes, can be observed in [2]. These circuits differ in their choice of microcontrollers and other components but the essential working is the same. Even though their design is simple, these machines do not consider security aspects. They also have constraints on the maximum number of candidates and votes. Also, they are limited to a single booth voting and procuring results, all within a specified area. On the other hand, the design proposed in this paper emphasizes greatly on security-related issues. Its main advantages lie in its ability of transmitting data over distances, thus achieving a large range between voting booth and result storage. Also, voting can be stretched across multiple booths, yet procuring results together at a single place, immediately.

The hardware realized in [4] is very complex owing to the use of Bistablemultivibrators and a number of seven segment displays.The Biometric Authentication incorporated into a voting system offers a secure and fair process [5].Similarly, the voting systems designed in [6], [7], [8] and [9] are effective in solving security problems concerning the voting procedures. But other drawbacks discussed are left unsolved. This design, hereby presented has also offered a safe technique to store the results post-voting. A voice activated mobile controlled voting machine design is also discussed in [10]. This design

provides a secure system, along with flexibility and scalability. But the design is complex as compared to the design proposed in this paper.

This proposed design has successfully overcome the shortcomings of security, complexity of hardware and reduction of manpower along with time required for various procedures.

The paper presented henceforth, is constructed systematically as follows.

Section 2 provides the entire hardware design of the circuitry, clearly divided into sub divisional blocks according to the working.

Section 3 talks about the software realization of this circuit, i.e., the coding and programming to the microcontroller. The steps of the code are also diagrammatically represented in the form of a flowchart.

Section 4 summarizes the entire design put forth through this paper, discussing its pros and cons. A brief paragraph has been included about the future extendibility of this circuit, extending this circuit with multiple advanced features.

Applications

The design of an electronic voting machine being discussed here can be implemented in a number of different places:

- Small scale voting sessions like the student body elections,
- Business meetings and sessions,
- Large scale voting for regional elections,
- Share market meetings,
- Institutional level and organizational level elections,
- Performance appraisals based on ratings.

Advantages

The electronic voting machine designed in this section has a wide range of advantages. Some of them are listed here:

- Security: The entire voting procedure is well-secured and protects the privacy of the voter. There is no chance of any mishandling or manipulating the vote count. This design ceases the case of invalidity of votes.
- Area of scope: It also helps in performing elections at far off rural areas but enables smooth control of the entire process and also helps to obtain their results at the central headquarters. Since the machine is compact and portable, it can be easily built and transported.
- Hardware design: The entire module of the voting machine can be constructed using minimal hardware. Thus, it reduces the bulk of the hardware and facilitates easy transportation, easy setting up and easy post-elections removal.
- Extendibility: The design of the hardware is very flexible and can be extended to include any number of features as per requirement. There is an advantage of choosing the type of display screens, the mode of communication, or the microcontroller itself, and the same system can be built with the respectively chosen components.
- Compatibility: The entire design is compatible to a high degree and to many other criteria and circumstances.
- User-friendly: The entire module is very clear and easy to operate to all the users. The voters are required to press a button against the respective candidate whom they desire to vote for, after being authenticated.
- Availability of microcontrollers: The 8051 microcontroller is the cheapest, most readily available product in the market. Hence, working with it is no hardship. It is also very simple to work with and clear with its operations. The Assembly level code for this is also not hard to understand. Also, 8051 has a number of advantages and features that can be utilized judiciously.

II. HARDWARE DESIGN

The electronic voting machine can be designed with a set of minimal electronic components interfaced with an appropriate code. The design can also be modified to incorporate a number of additional features. The design discussed here is an undemanding and an easily constructible concept. The basic block diagram of the entire design is as shown in Fig.1. The photographs of the actual working project constructed, are shown in Fig. 2 and Fig. 3.

The entire hardware circuit consists of a number of functional blocks. Each of them are considered and discussed individually.

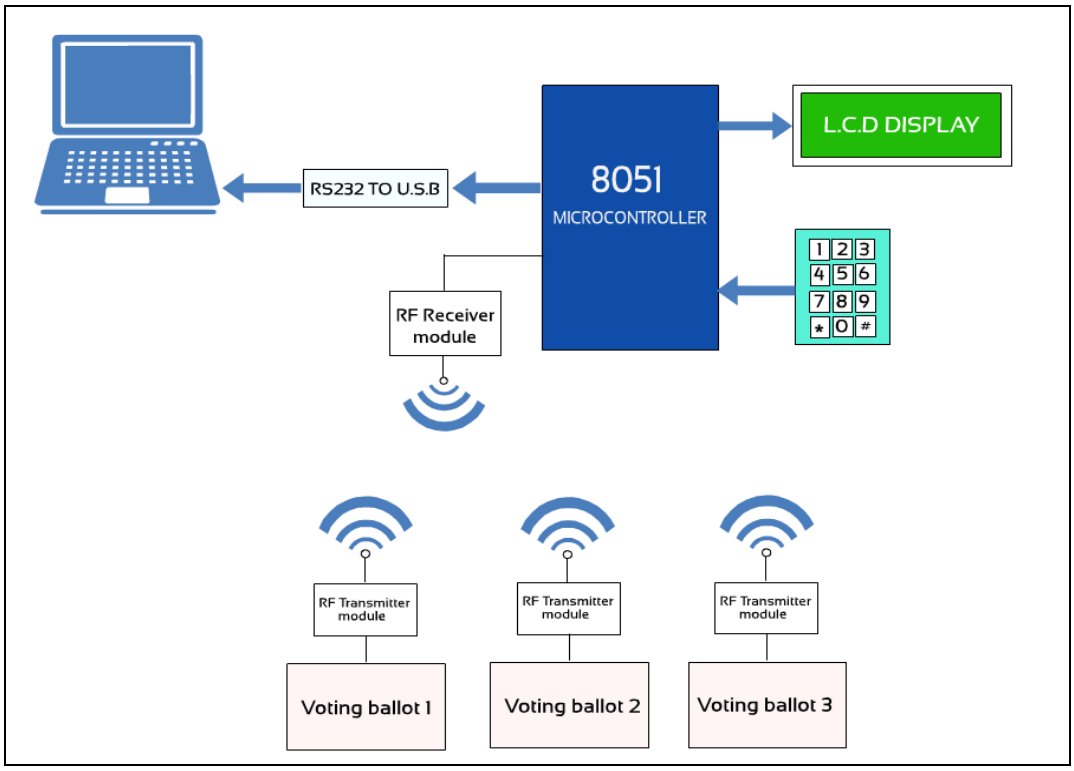

Figure 1: Basic block diagram of the complete voting machine circuitry

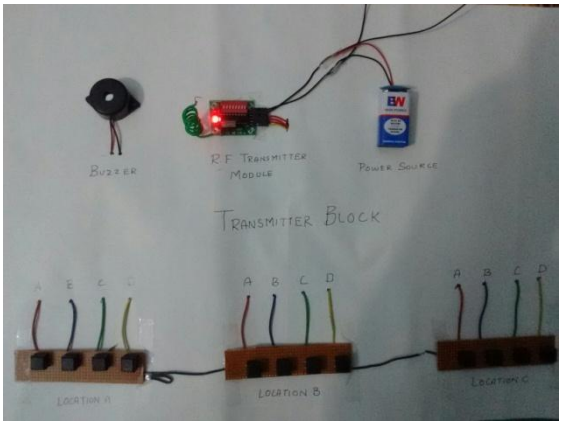

Figure 2: Voting Module and Transmitter Block of the Voting Machine

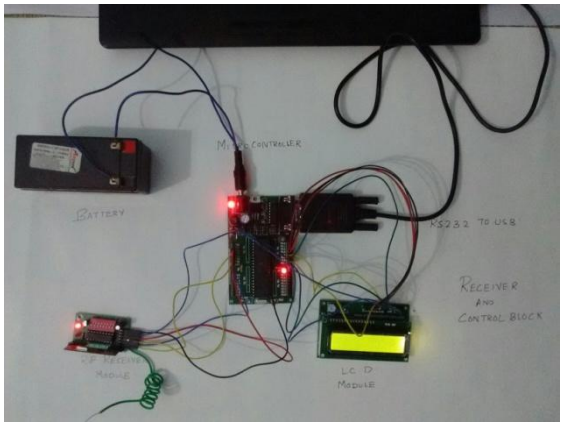

Figure 3: Receiver and Control Block of the Voting Machine

2.1. *MICROCONTROLLER*

The microcontroller is the brain of the whole machine. It operates as it is instructed by the program burned /downloaded into it. The minimum connections required for the microcontrollerto operate, such as power sources and clock circuits, are set up. All the necessary peripherals are interfaced and the code is written in the exact way that we need the microcontroller to work. Discussing the working of the microcontroller, it initiates, proceeds and oversees every part of the functioning. Initially, the whole machine is turned ON or OFF by the microcontroller. Once it is ON, the voting procedure is commenced by an interrupt signal served to it. The microcontroller is required to induce the display system to convey to the voters the basic information about the procedure and the contesting candidates. It then receives the votes cast by the users and transmits it to the receiving database as an increment in the count of the respective candidate. On the receiving end, the microcontroller has individual memory slot to store the vote count of each candidate. It is necessary to ensure there are no flaws in incrementing and storing the counts till the end of the voting procedure. The working of microcontroller can be represented by the diagram in Fig. 4.

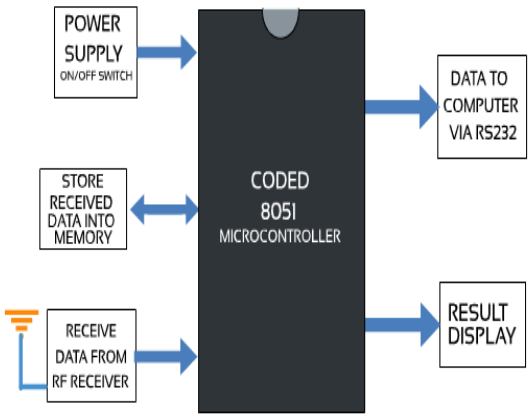

Figure 4: Functions of the microcontroller

The connections to the microcontroller can be easily done by studying the pin diagram of the 40-pin 8051 IC [11] [12]. The I/O port functioning are studied in detail and connections are made considering our requirements [13]. The working of the IC according to our connections is controlled by the code downloaded onto it.

The microcontroller has a bi-directional interaction with each and every component of the complete system. It has to give instructions and monitor their working, and at the same time receive data from them and proceed to the next stage. Ultimately, it is the microcontroller which is responsible for the perfect working of the entire voting machine.

2.2. THE VOTING MODULE

The voting module is to be set up in each of the individual booths where the voting has to be conducted. The basic needs for this module are a medium to instruct the voter what has to be done and a medium through which a voter can cast his votes. A simple module of an electronic voting pad is constructed as shown in the Fig.5. It can be constructed by a number of switches or pressbuttons, one for each of the candidates contesting. The names of the candidates should be clearly indicated against the switches. It should show no traces of indication of the previous votes cast. This set up is the major component that the voting machine comprises of.

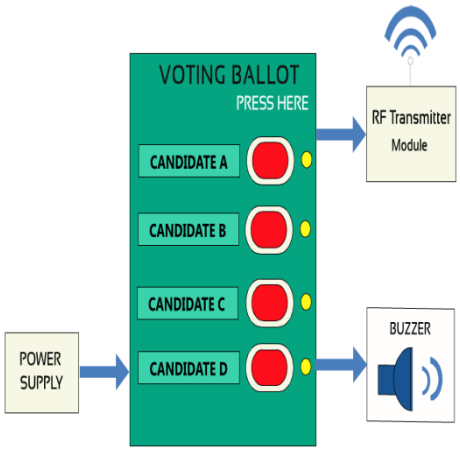

Figure 5: The Voting Equipment constructed in every polling booth

These are installed in every individual booth for separate polling process. A buzzer indication after each vote cast enhances the security of the machine further. The buzzer is also programmed to signal any attempts to violate the procedure.

Connections are made from these switches to the RF transmitter module in each voting module. This is the only necessary wired data transfer medium in the entire design. The RF Transmitter then transfers this vote count simultaneously to the receiver database. The data transfer from each booth to the single data storage area can be regulated by the means of a decoder.

Another important requirement for this module is the security. The voter has to be sure about his vote being secure and not tampered with. Since the vote count is immediately transferred to the database, there is not such chance for malpractices. Also, invalid votes are to be eliminated. This can be done by the simple programming of the microcontroller lengthening the timing of switches pressed or held. The minimum delay between every vote cast is also to be specified. Buzzer indication after every vote cast enhances its security further. This module is to be set up in every booth where the voting sessions are to be held. A small-scale number of 4 candidates have been chosen in the circuitconstructed.

The hardware is essentially minimal and requires less expenditure and manpower. Since there is no restriction on the maximum number of votes that can be cast, nor on the number of candidates, it can be easily compatible to any application. The distance within which the voting booths can be set up from the receiving center is dependent on the range of the communication channel used. The area covered by the voting region can be very vast, thus, slackening the constraints on a number of aspects like security, manpower, patrol, complexity of procedure and the time consumed.

2.3. THE WIRELESS COMMUNICATION MODULE

The communication module performs the most crucial step in this design of the machine. It is the channel between the voting module and the receiver database. This channel has to be secure and impregnable to tampering. An RF wireless transmission technique has been employed in thisdesign. The RF module operates at Radio Frequency, its frequency range varying from 30 KHz to 300 GHz. In this type of transmission, the carrier wave amplitude contains variations corresponding to the digital data to be transmitted. The RF signals are strong and can propagate to the receiver even if there is an obstacle on its path. They can cover longer distances without much loss in signal power. Hence, they are the best media for mediumrange communication. There is also not much delay in transmission. The currently utilized small-scale RF module had a communication range of 10 meters with the use of antennas. This RF module comprises of an RF Transmitterand anRFReceiver. It is usually used along with a set of encoder and decoder. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna. The encoder is utilized for encoding the parallel data to be fed to the transmitter. The

transmission itself occurs at the rate of around 1Kbps to 10Kbps. The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter. Before that, the decoder at reception end decodes the data.

The transmitter-receiver pair operates at a frequency of 434 MHz.HT12E-HT12D is the currently used encoder/decoder IC pair along with the RF Module.

The specifications of the RF transmitter used are listed below in Table 1 given below.

Table 1: Specifications of RF Transmitter Module

PROPERTY	SPECIFICATION OF RF TRANSMITTER
Working voltage	3V~12V
Working current	max≤40mA (12V), min≤9mA(3V)
Resonance mode	Wave Resonance (SAW)
Modulation mode	ASK
Sound Working frequency	315MHz-433.92MHz
Transmission power	25mW (315MHz at 12V)
Frequency error	+150kHz (max)
Velocity	≤10Kbps

A number of transmitters are installed in each of the operating voting booths. All these transmitters have a single receiver at the data storage location. Each transmitter is accompanied by a encoder and the receiver with a decoder respectively. By means of proper coding, the data flow can be regulated through these channels. During voting process, all the transmitters are encoded with a same code. The receiver decoder is fed with the appropriate code such that all transmitters are open to it and it can receive data simultaneously from every booth.

Fig. 6 summarizes the complete operation of the communication module. It diagrammatically shows how a channel is formed between the voting machine and the storage area.

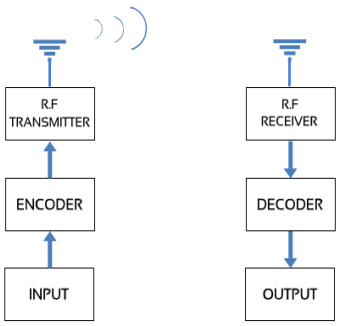

Fig. 6: The wireless communication module

2.4. THE RECEIVER MODULE

The last hardware block of the voting machine is the receiver part and the storage. This consists of a RF receiver, a storage space, and an LCD screen for displaying of the results.

2.4.1. RF RECEIVER

The RF receiver at the reception end is always attached with a decoder to regulate the data flow through the RF channel. The receiver should be capable of simultaneous reception of data from all the transmitters used in every booth. The specifications of the RF receiver used in this design are listed below in the Table 2.

Table 2: Specifications of RF Receiver module

PROPERTY	SPECIFICATION
Working voltage	5.0VDC +0.5V
Working current	≤2.5mA (5.0VDC)
Working method	ASK
Operating frequency	315MHz, 433.92MHz
Bandwidth	2MHz
Sensitivity	excel –105dBm (50Ω)
Output signal	TTL electric level signal entire transmit

2.4.2. STORAGE UNIT

The next part is the storage unit. For the small-scale machine designed in this system, the 4 kilobytes internal memory of the 8051 microcontroller is sufficient. But large scale applications would need external storage areas or databases interfaced.

The 8051 is coded with instructions so as to allocate separate memory space for the vote count of each candidate. It initially stores a zero value. As the voting starts, any vote cast for the respective candidate is transmitted as digital data and each time, the value of vote count of that candidate is incremented. This process continues till the voting process is halted. Hence, by the end of it, those memory spaces contain the total and final vote count of each candidate across all booths.

The access to this memory location is to be highly protected. It is to be made available to only those in authority. This can be done by including a password enabled access system. A keypad has been installed and only those with the correct password are allowed to view the vote counts and results. Only when the results are to be announced will the data be unveiled. Thus, the authority regulates the flow of result information to the public.

2.4.3. DISPLAY

A display system, such as an LCD Display interfaced in this design, performs the final task of announcing the results of the voting procedure to the

public. It is to be effective and clear with the results and decisions hence undertaken.

The interfacing of the LCD Display to the 8051 is a very important procedure. To interface an LCD specific commands have to be included in the code. Also the connections are fixed and standard [14] [15]. Along with the mandatory basic connections and code, additional points can be added for our purpose.

In this case, the LCD display first displays the final vote count of all contestants. Including a few introductory words, it announces the name of the winner. These instructions are included in our code. An exemplar diagram showing results on the LCD screen can be depicted by the following block diagram in Fig. 7.

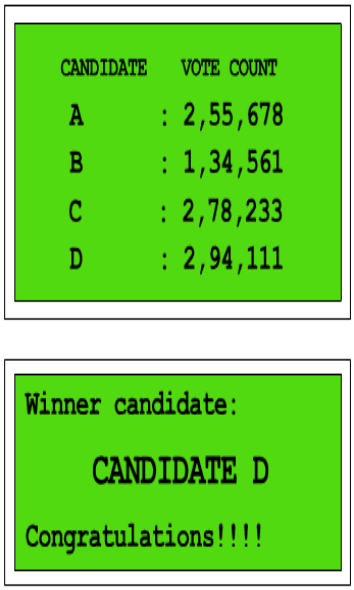

Fig. 7: An LCD Display showing results of the election

Another advantage of this design is that the data can be transferred back to a computer too. An RS232 cable is an interfacing standard used to allow compatibility among data communication equipment [16]. It communicates between a PC and the peripherals by mostly hand-shaking signals. The microcontroller is connected to the RS232 after making them voltage compatible. The other end of RS232 is connected with the USB of the computer so as to form a channel for serial communication. The vote counts and results can be then transferred and stored in the computer. By this, the data can also be utilized for many other further purposes and as the data to further processing.

III. CODING

Coding is another important software aspect for the functioning of the voting machine. The coding has to precisely elucidate each and every step to be followed. It also has to take care of some unforeseen crisis that may occur, taking the appropriate action. This code is then burned into the microcontroller so that it works according to the code. The program can be written using any language and appropriate software. Embedded C code is the most preferred language that could be written usingKeil. This software was the software that was used to make the circuit as shown above.

The building of the code for the working of the voting module can be explained using the flowchart shown below in Fig. 8.

The coding is fundamental to the working of this design. It has to include each and every step to be performed, with instructions in the right format [11].The flowchart in Fig. 8 specifies each step the microcontroller executes from the switching the circuit on to the final display of results. All actions are clearly stated. It is also instructed to check the functioning of each block at intervals. Also, it is to detect any disturbances or deviations from the specified actions. It should specify what must be done in unforeseen hindrances, like notifying the required authority and protecting its current state of the microcontroller. Similarly, malfunctioning of any block or any hardware impediments should also be brought to the authorities' notice by the microcontroller. It is in programmer's hand to code the controller with clear-cut instructions, foreseeing every possible obstacle and preparing the controller to rectify them.

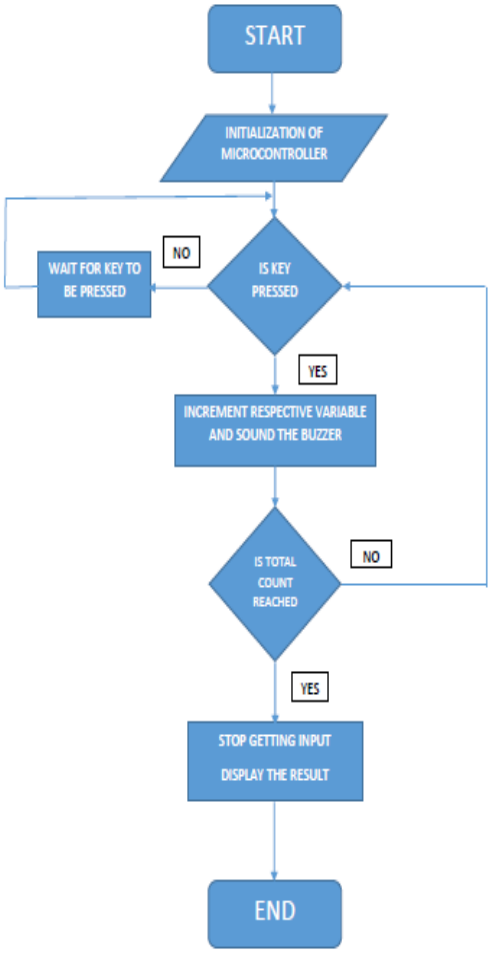

Fig. 8: Flowchart depicting the code to be downloaded to the microcontroller

IV. CONCLUSION

This paper discusses an improvised design of an electronic voting machine which makes polling much faster and more reliable. The concept is easily implementable and hardware minimal. It is a cost effective design and enhances the security. Malpractice can be prevented to a large extent. It puts forth a new idea of simultaneous voting but working together. Wireless communication is today, very common and thus, it is not hard to extend its applicability to the voting procedures. Since voting is the fundamental block of the democratic world, it needs to be as efficient as possible. The design proposed through this paper is one attempt to do so.

With the technology growing dynamically every day, this electronic voting machine can be upgraded including the latest and more advantageous features to step over all shortcomings and adapt. Some of the ideas that could be incorporated into this design are a Biometric security system, a computerized DB (database), an audio system or GUI's for casting votes, and Bluetooth, WI-FI modules, and LAN et cetera for data transmission.

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REFERENCES

[1]. S.V. Prashanth, R. Mekala, "A literature survey on microcontroller based smart electronic voting machine system", International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE), Vol. 3, Issue 12, Dec 2014.

[2]. Mr.SoumenGhosh, "Development of microcontroller based electronic voting machine (EVM)", IOSR Journal of Electrical and Electronics Engineering (IOSR-IEEE), Vol. 9, Issue 2, Mar-Apr, 2014, pp 01-03.

[3]. A. Suleiman, S. Zubair, H.T. Abdulazzez, B.A. Salihu, Y. Salihu, "Design and construction of a simple microcontroller based conference electronic voting machine with digital display", International Journal of Advanced Research(2013), Volume 1, Issue 2, 145-153

[4]. Md. MurshadulHoque, "A Simplified electronic voting machine system", International Journal of Advanced Science and Technology, Vol.62,(2014), pp.97-102.

[5]. Sanjay Kumar, ManpreetSingh, "Design a secure electronic voting system using fingerprint technique", IJCSI International Journal of Computer Science Issues, Vol. 10, Issue 4, No. 1, July 2013

[6]. O. Iloanusi and C. Osuagwu, "Framework for a dynamic fingerprint indexing biometric based voting system", African Journal of Computing &ICTs, pp.55-63, Vol.5(4), 2012.

[7]. Altun and M.Bilgin, "Web based secure e-voting system with fingerprint authentication", Scientific Research and Essays, Vol. 6(12), 2011, pp. 2494-2500.

[8]. K.Memon, D. Kumar and S. Usman, "Next generation a secure e-voting system based on biometric fingerprint method", International Conference on Information and Intelligent Computing (IPCSIT), pp.26-32, 2011.

[9]. S Kumar and M Singh, "Security enhancement of e-voting system", Global Journal of Computer Science and Technology, Vol. 12, Issue 5, Version 1.0, March 2012.

[10]. AmarpreetKaur, YashKalyani, Singh KushagraHarila, Rahul Madhesiya, "Microcontroller based voice activated mobile controlled electronic voting machine", International Journal of Advanced Research in Computer and Communication Engineering, Vol. 2 issue 3, march 2013

[11]. Muhammad Ali Mazidi, Janice GillispieMazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded

[12]. Systems", Second edition, Pearson Education Inc. 2006
[13]. Dr. K. Uma Rao, Dr.AndhePallavi, "The 8051 and MSP430 Microcontrollers- Architecture, Programming and Applications", FILLIP Learning, 2012
[14]. Kenneth. J. Ayala, "The 8051 Microcontroller- Architecture, Programming and Applications", Second Edition, Cengage Learning
[15]. Dr. Rajiv Kapadia, "8051 Microcontroller and Embedded systems", Second Jaico impression: 2007, Chapter 8
[16]. Craig Steiner, "The 8051/8052 Microcontroller- Architecture, Assembly Language, and Hardware Interfacing", WP Publishers and distributors, 2006, Chapter 19, pg 245-258
[17]. V. Udayshankar, M. S. Mallikarjunaswamy, "8051 Microcontroller- Hardware, Software and Application", Tata McGraw Hill Education Private Limited, Fifth reprint 2011, Section 8.6, pg. 220-222.

Authors Profile

Abhishek Joshi is currently pursing B.E. degree in electronics and communication from R.N.S Institute of technology, Bangalore, India. He has a research paper published in his name.

Harish.S is currently pursing B.E. degree in electronics and communication from R.N.S Institute of technology, Bangalore, India.

Ashwini.H.R is currently pursing B.E. degree in electronics and communication from R.N.S Institute of technology, Bangalore, India.

Harshitha.R is currently pursing B.E. degree in electronics and communication from R.N.S Institute of technology, Bangalore, India.